

ASHTON VIADUCT

HAER No. RI-43

(Joseph A. Russo Memorial Bridge)

(State Bridge No. 275)

State Route 116 (Washington Highway) spanning  
the Blackstone River, the Blackstone Canal ~~River~~,  
the Providence and Worcester Railroad

Ashton vicinity

Providence County

Rhode Island

HAER

RI,

4-ASH.V,

2-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

National Park Service

Northeast Region

Philadelphia Support Office

U.S. Support Office

200 Chestnut Street

Philadelphia, P.A. 19106

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Location: State Route 116 (Washington Highway), spanning the Blackstone River, the Blackstone Canal, and the Providence and Worcester Railroad Ashton vicinity, Providence County, RI

UTM: 19.298180.4645580

USGS Quadrangle: Pawtucket, RI 1:24,000

Date of

Construction: 1934-5 (substructure), 1942-5 (superstructure)

Designer:

Samuel A. Engdahl  
Engineer, Bridge Department  
R.I. State Department of Public Works  
(R.I. Department of Transportation)

Present Owner: State of Rhode Island/Department of Transportation  
Providence, Rhode Island

Present use: Vehicular and pedestrian bridge

Significance: The Ashton Viaduct is one of the State of Rhode Island's largest engineering projects. It is a fine example of open spandrel design and, as the northern terminus of the Washington Highway, an important link in the state's highway system of the post-World War II era.

The Ashton Viaduct is an inventoried contributing resource of the Blackstone River Valley National Heritage Corridor, spanning both the river and the Blackstone Canal Historic District. It is also adjacent to the Ashton (Cumberland) and Old Ashton (Lincoln) Historic Districts. It was determined eligible for listing in the National Register of Historic Places on January 10, 1989.

Project

Information:

The Ashton Viaduct is structurally deficient due to extensive concrete deterioration. Reconstruction of the bridge will result in an adverse effect. A Memorandum of Agreement was ratified by the RISHPO, FHWA and the Advisory Council on Historic Preservation on May 3, 1995. It includes a stipulation requiring HABS/HAER documentation. This report was prepared to satisfy that stipulation.

Edward Connors and Associates  
29 Allen Avenue, Barrington, RI 02806

## HISTORICAL BACKGROUND

### **The Crossing**

The earliest known crossing of the Blackstone in the vicinity of the Ashton Viaduct was Pray's Wading Place, a 17th century ford in the general location of the Martin's Way Bridge, 3/4 mile south of the viaduct. Later, a three-span, timber bridge linked the village of Old Ashton with its counterpart on the Cumberland side (see below).<sup>1</sup> The Ashton Bridge, a ca. 1900 steel Pratt-type truss of two 80' spans crossed the Blackstone at a location just below and to the south of the viaduct.<sup>2</sup> It was dislodged from its abutments and pier during Hurricane Diane in August 1955 and dismantled shortly after. The regularly coursed, granite ashlar abutment of this bridge survives in good condition on the west side of the river. The remains of the east abutment are incorporated into the river retaining wall at the site of a single story, mid-20th century industrial building.

### **The Blackstone River Valley**

The Ashton Viaduct carries the Washington Highway over the Blackstone River, the Blackstone Canal and the Providence & Worcester Railroad. These three historic features and their relationship to each other are explained briefly below.

The Blackstone River, extending 46 miles from Worcester, Massachusetts, to Narragansett Bay, was recognized by early settlers as an important source of water power.<sup>3</sup> The falls at Pawtucket provided the power for Samuel Slater's textile mill (1793), the mill that heralded the American industrial revolution. A succession of mills and mill villages appeared at points along the Blackstone north from Pawtucket in the early to mid-19th century.

### **The Smithfield Cotton and Woolen Company and the Blackstone Canal**

One of the earliest of these was the Smithfield Cotton and Woolen Company, its dam on the Blackstone, and its neighboring mill village (1810-1815). As described in a 1991 *Rhode Island History* study of the site, this mill "represented one of the first efforts, outside of those of the Slater family, to bring mechanized textile spinning to America."<sup>4</sup> This enterprise had failed by 1817 in the economic downturn that occurred after the War of 1812.<sup>5</sup>

Wilbur Kelly, a ship's captain in the employ of the Brown and Ives family interests, purchased the 17-acre site in November 1823. It is likely that Kelly, aware of the planned location of the Blackstone Canal at the time of his purchase, saw this intrusion into his property as a clear economic benefit.<sup>6</sup> In brief, the canal (in the general location of his existing mill trench) would provide him with more reliable water power and immediate access to shipping.

In 1826, Kelly sold the now-profitable site to the Lonsdale Water Power Company in return for stock, a position as mill agent, and a sum of \$900. His responsibilities with the parent company brought him further afield during this period. In the mid-1830s, Kelly put his son, Christopher, in charge of the operation. At that time the Lonsdale Company erected a 1 1/2-story dwelling for him that survives on the land between the canal and the river south of the viaduct in Old Ashton.

By the 1840s the Lonsdale Company, now a prosperous textile manufacturer established 2.5 miles downstream at Lonsdale, had built a large extension on the original Smithfield Mill and converted it for the manufacture of sheeting. It was used in that capacity until 1869 when it was made a warehouse. The Lonsdale Company also purchased a large tract of land on the Cumberland side of the river. By 1869 the company's substantial new brick mill, called the Ashton Mill, dominated the east bank of the Blackstone. The original Smithfield Cotton and Woolen Company mill was demolished before the bridge project began. An archaeological survey has located the mill foundations just north of pier B. Four of the original millhouses, as well as the Kelly house described above, survive at the end of Lower River Road as part of the Old Ashton Historic District.<sup>7</sup>

#### The Providence and Worcester Railroad

The same investors who had created the Blackstone Canal Company and the Lonsdale Company established the Providence and Worcester Railroad in 1844. The canal, never a profitable venture, had its demise as a result of increased rail competition in the '30s and '40s. These investors purchased the lands of the defunct canal company for the purpose of laying out a railroad line from Providence to Worcester; by 1847 the line was in operation. It remained independent until 1892 when it was acquired by the New York New Haven & Hartford Railroad. In this century the Depression, the rise of the automobile, and commercial trucking contributed to the railroad's tenuous financial state. After a long period of legal struggle, a new Providence & Worcester

Railroad--unrelated to the original company--was created in 1973.

Span EF, the easternmost arch of the Ashton Viaduct, spans the tracks--still in use--of the Providence & Worcester Railroad.

### Rhode Island's Concrete Bridges

In 1892 the Rhode Island General Assembly appointed a committee to assess the State's road conditions. In a report delivered to the General Assembly three years later, the Committee "found very little to commend."<sup>8</sup> The eventual result of this survey of some 2420 miles of inadequate roads was the establishment of a State Board of Public Roads (SBPR) in 1902.

The rapid rise of automobile use in the period from 1900 to 1915 spurred many states to establish highway departments. With a pressing need to quickly replace great numbers of deficient or inadequate bridges, these agencies turned to standardized designs that could be easily adapted to the specific characteristics of span, foundation, roadway, and intended use.

In 1912 the Rhode Island General Assembly enacted a Bridge Law calling on the SBPR to examine the 156 bridges located on the State's public roads. Upon completion of this assessment the SBPR was to supervise the construction, replacement or repair of any bridges "lying in or on upon the State roads which had been improved by the State"<sup>9</sup> since the formation of the Board ten years earlier. The investigation would be carried out by a newly-formed Bridge Department under Chief Bridge Engineer Clarence L. Hussey.

Hussey was an advocate of concrete bridges. The first reinforced concrete bridge on a Rhode Island public road and constructed under state supervision, the Flat River Bridge in Coventry, had served the state well--and maintenance free--since 1907.<sup>10</sup> In light of this success story, one of the first tasks of the Bridge Department was to standardize a system of reinforced concrete bridge design, a system in which basic designs could be adapted to the varied circumstances of Rhode Island's roads.

### Washington Highway

A July 1931 feature article in the *Providence Journal's Sunday Magazine* described a "Cumberland-Coventry Highway" to be named for George Washington on the 200th anniversary of his birth. Composed of sections of new and existing highway extending

approximately 25 miles from the Massachusetts line near Attleboro to the village of Washington in Coventry, the road would

...provide a new "beltline" or circuitous route around Providence, at approximately a constant distance from it. While the Victory Highway [State Route 102], already in existence, may be considered as a route constituting the circumference of a large circle, the Washington Road will make a lesser circle about the city at something like a 15-mile radius, connecting the "spokes" of the larger "wheel."<sup>11</sup>

In a January 1932 description of progress on the Washington Highway project, the Bridge Department of the SBPR described "viaduct structures...longer and higher than any heretofore encountered in our State highway work."<sup>12</sup> While much of the roadway from Washington to the Farnum Pike in Smithfield already existed as local roads, a new road was required from that point east to Ashton. The SBPR chose to span the entire Blackstone Valley "at a high level, obviating the steep grades, sharp turns and low-capacity turns on the present route which descends to the valley floor."<sup>13</sup>

The Board authorized construction in 1932 of 4.2 miles of road from the Farnum Pike to the Old Louisquisset Pike. This section of the Washington Highway, completed in July 1934, required a crossing of the Woonasquatucket Valley at Stillwater.<sup>14</sup> An imposing project in itself, the Stillwater Viaduct served as a testing ground for the massive structure required to cross the Blackstone Valley five miles to the east at Ashton.

### The Ashton Viaduct

State engineers had surveyed and photographed the Ashton area as early as May 1930 and test borings were begun along the proposed path of the Washington Highway at Ashton in January 1932. Samuel A. Engdahl,<sup>15</sup> Bridge Engineer for the SBPR, designed the viaduct between November 1932 and June 1933. The State requested bids in August 1934 for clearing the land and construction of the abutments and footings for the six piers. These ranged from a high bid of \$460,895 to the successful low bid of \$304,920 submitted by Frederick Snare Corporation (New York, NY). Work began on September 26, 1934.

Less than a year later, the substructure work was complete. On August 5, 1935 the Bridge Section of the newly-reorganized RI

Department of Public Works<sup>16</sup> (DPW), in its *Certificate of Approval of Completion*, stated:

The major construction work was complete on July 16, and the plant dismantled and the site cleared on August 3, 1935 except for temporary bridge, railroad siding, field office and construction sheds left by special arrangement for the benefit of the future superstructure work.

At that time the DPW had little idea how remote that future might be.

Mired in the sixth year of the Great Depression, Rhode Island found itself with no funds for the superstructure phase of the Ashton project. Despite this, some ledge excavation was performed north of pier F (near the east abutment) in the fall of 1935. In the following years the Bridge Section had little recourse but to conduct occasional inspections, most notably after the high waters of March 1936 and July 1938, the latter washing out the temporary bridge erected during the substructure work.

By 1940 the United States, still noisily debating its role in the war that had engulfed Europe and Asia, was, nonetheless, preparing militarily for its inevitable entry into the conflict. In analyzing Rhode Island's road system, Federal officials had identified Nooseneck Hill Road (State Route 3) as a vital military route from South County to New York and Connecticut. In light of this federal interest, state officials hoped that the stalled Washington Highway project might take on a new urgency when viewed as a military route from Nooseneck Hill Road to the north.<sup>17</sup> Despite this optimism, a go-ahead for phase 2 of the Washington Highway--from the Louisquisset Pike east to Mendon Road--would have to wait until wartime.

In February 1941 the State reassessed the condition of the site abandoned six years earlier and, later that year, sought bids for the superstructure phase of the project (Federal Aid Project 67-C-1) and the linking of the Washington Highway with Mendon Road (Federal Aid Project 41-E-1). New specifications from a 1940 redesign included revisions "to conform with the latest highway bridge practice for width, alignment and grade...."<sup>18</sup> During the time elapsed between the original 1933 design and the refunding of the project in 1941 national standards for roadway width had undergone a change: due to increased vehicle speed, the recommended 10' travel lane had been widened to 11'-12'.<sup>19</sup>

Thus, the viaduct roadway was widened from 40' to 44'.

Five contractors submitted bids by December 10, 1941; these ranged from a high of \$501,927 to the successful low bid of \$398,660 submitted by Frank T. Westcott (Attleboro, MA). Westcott began work on March 30, 1942

In the interval between the State's request for bids in November 1941 and the resumption of work the following March, the United States found itself in a state of war. In April 1942 work was resumed on the viaduct according to the following plan: Working westward from the Cumberland side, Westcott began work on the centering and forms for the south rib of span E-F. When the pour was complete, the same centering was moved northward for the adjacent north rib. In a similar fashion, the forms used for the pouring of the south shaft of pier F were relocated for use in the identical north shaft. After a winter respite in early 1943, this westward pattern proceeded up to the time of construction of spans A-B, B-C and pier C in March of that year.

In the aftermath of Pearl Harbor the Federal Government's Office of Production Management had reorganized itself as the War Production Board (WPB) and begun an assessment of the nation's extant construction projects, evaluating them for military importance and, based on this assessment, issuing a priority rating.

The WPB assigned the Ashton Viaduct/Mendon Road project a P-19-e rating in late July 1942. This rating permitted continuance of the project until a reappraisal in late March 1943 brought work to a halt. The WPB, in its "Revocation of Preference Rating," stated the following:

The fulfillment of requirements for the defense of the United States has created a shortage in the supply of metals, lumber and other materials used in construction, for defense, for private account and for export, and of construction machinery and other machinery used in construction; and the following order is deemed necessary and appropriate in the public interest and to promote the national defense.

The Bridge Department had 15 days to tie up any loose ends related to "safety or health or to avoid undue damage to or deterioration of materials already incorporated." In the same document the State was informed of its right to appeal this

revocation of the preference rating that had allowed them to continue work in wartime.

William J. Long, Deputy Director of Public Works, appealed the revocation in a April 5, 1943 letter to the WPB. The full text of this letter--describing the military importance of the project as well as the public safety issues related to a cessation of concrete work on the two remaining arches--is found in the **Supplemental Materials** section of this report. This letter and a subsequent telegram of April 16 convinced the WPB to cancel its previous Revocation of Preference Rating effective May 7, 1943.

Construction work was resumed in June; by July all five arches were complete. By January 1944 the spandrel columns, rough deck work, and sidewalk brackets were completed. By November Westcott had placed the asphalt road surface. A month later the bridge was opened to essential traffic.

One difficulty unanticipated in the pre-war years was the necessity for innovative re-use of timber for centering and plywood for concrete forms. A ca. 1944 *Providence Journal* article describes some of these measures:

The bridge engineers point out that a great deal of ingenuity was required to proceed efficiently with the work by using a minimum of equipment, men and incidental construction materials. On this basis alone the project is most interesting from an engineering and construction standpoint.

The structure was so designed that multiple re-use of construction materials was expected. When the exigencies of the times demanded conservation of both manpower and materials, the actual re-use and application of available concrete form materials was beyond any early expectation.

Heavy timber first obtained for the falsework and centering was re-used from two to four times for the original purpose, then dismantled and re-cut for many more uses in lighter functions.

As the bridgework progressed upwards, complicated staging was involved and, which, with column, beam, and slab forms, were used ten to twelve times. A very limited amount of sheet forms of the plywood type were stretched throughout the construction period for various uses, ranging between

twenty and thirty times. This repeated service was made possible by reinforcing the corners and other vulnerable parts with thin sheet metal clips. Special forms for the rail base posts and balusters were carefully fabricated so that they have been or will be used ten to twenty times.<sup>20</sup>

Despite chronic shortages of skilled men and continued difficulty in the procurement of supplies, Frank Westcott completed work on both the Ashton Viaduct and the Mendon Road approaches on July 11, 1945. In the post-war years the DPW scrapped its original plan to create a grade separated interchange at Mendon Road and continue the Washington Highway through to Route 1 in North Attleboro.

## SIGNIFICANCE

### Summary

With an overall length of 926 feet, the Ashton Viaduct is the second longest multiple-arch, concrete structure in Rhode Island.<sup>21</sup> Conceived as a vital link in a new automobile "beltway" route around the Providence metropolitan area, this structure was built at great expense during the early years of the Depression, suspended for a period of seven years due to lack of funding, and completed during wartime conditions of scarce labor and materials. The Ashton Viaduct stands as a monument to the State's bridge engineers and the two construction companies who realized this beautiful and durable structure under extraordinary circumstances.

Begun 27 years after the construction of the first State-supervised concrete arch bridge, the Ashton Viaduct demonstrates the Bridge Division's confidence in the structural capabilities of reinforced concrete and a continuation of the innovative work in that material begun by Clarence Hussey of the SBPR in 1913.

In 1989 the Ashton Viaduct was renamed the Joseph A. Russo Memorial Bridge. Russo (1899- ), originally hired by Clarence Hussey in the early 1920s, worked for the SBPR and its two successor agencies. He was field inspector during the superstructure phase of the project. Russo, now in his 90s, was interviewed on videotape at the time of the rededication. Among his general observations on the subjects of the SBPR Bridge Department, concrete work, and the wartime building of the viaduct was a salute to Dave Johnson, Superintendent of Construction for Frank Westcott, the contractor for the superstructure phase of the project. Johnson's integrity and spirit has remained in Russo's memory these fifty years.<sup>22</sup>

### Concrete Bridges

The use of concrete as a construction material dates to the Hellenistic period when Greek engineers used it in the building of aqueducts. Concrete's first wide use is, however, associated with the Romans, who combined locally available volcanic sands with lime and aggregate as early as 200 BC. This combination provided a durable material, often used in combination with masonry or brickwork, that survives to the present in surprisingly good condition. Although there is evidence of the use of bronze rods for reinforcement,<sup>23</sup> Romans used concrete primarily as a masonry substitute, a material strong in

compression but weak in tension.

Concrete fell into disuse during the Middle Ages and was not reintroduced until the mid 18th century. In 1840 Joseph Aspdin produced "Portland" cement by the careful measurement and mixing of limestone and clay. The resulting stone-like material resembled the Portland building stone commonly used in England, hence the name. While Portland Cement, mixed with aggregate to make concrete, was superior to its ancient counterpart, it was not until the mid-19th century reintroduction of metal reinforcement that concrete came to be used as a material with strength in tension as well as compression.

By 1870 French engineers had employed plain concrete in the construction of arches for the Grand Maitre Aqueduct, part of the Parisian water supply.<sup>24</sup> On this side of the Atlantic, Ernest Ransome built the first reinforced concrete arch bridge in San Francisco's Golden Gate Park in 1889. Although this bridge represented a significant advance in bridge construction, its conservative design and surface treatment evoked the masonry types that preceded it. By the turn of the century, a new generation of bridge designers would begin to grasp the structural potential of reinforced concrete and begin to design to those possibilities.

### Open Spandrel Bridges

Among the many innovations in early 20th century concrete bridge design was the open spandrel arch. The closed spandrel wall of earlier masonry bridges carried over into concrete design was a conservative design measure not unlike those mentioned above. An effective way to limit deck load without sacrificing strength was the substitution of spandrel columns for solid spandrel walls and individual arch rings for a single arch drum. Frank McKibben, in a 1912 *Concrete-Cement Age* article describes this movement toward open spandrel design:

It was not long...until it was recognized that placing many tons of earth filling upon the arch was not a logical procedure, for it not only entailed considerable expense for the filling, but it required further expenditures in the arch ring and abutments. It was simply adding weight on weight to be further provided for in the design.... Open spandrels decrease the loads and permit a design approaching that distinctly peculiar to that of concrete.<sup>25</sup>

On the benefits of spandrel columns and arch ribs McKibben added:

In this style [of bridge]...the roadway is carried on beams supported by columns which in turn rest on arch ribs.... Nothing seems less scientific than a solid filled spandrel arch with a wide arch ring extending the entire width of the roadway. Compare this with a ribbed structure having a few ribs to support the roadway deck which is extended by cantilever beams to carry the sidewalks.<sup>26</sup>

This 1912 article aptly describes the general features of the Ashton Viaduct--arch rings, spandrel columns, and bracketed sidewalks. By that date there were a number of large-scale, open spandrel, concrete arch bridges in the United States.<sup>27</sup> The most significant of these, however, was the Tunkhannock Creek Viaduct completed three years later in 1915. This 10-span viaduct, 2375 feet in length, was described at the time as the largest structure of its kind in the world. Construction progress between 1912 and 1915 was widely reported in the engineering press and in student texts. It is likely that the success--and striking visual aspect--of this structure was well-known among the State bridge engineers during the planning and design of the Ashton Viaduct.<sup>28</sup>

## DESCRIPTION

The Ashton Viaduct is a multiple arch, concrete, open spandrel structure consisting of five sets of parallel pairs of arch rings and eight trestle approach spans. It rises approximately 70 feet over the Blackstone River, the Blackstone Canal, and the tracks of the Providence & Worcester Railroad. Its overall length is 926 feet, with a roadway 44 feet wide between curbs and two 4-foot bracketed sidewalks. Overall width is 56 feet.

Each arched span of the viaduct consists of two 14-foot wide, multi-centered arch rings. A 15-foot space separates these rings. Rising from each arch ring are four pairs of spandrel columns. These columns support floorbeams that, in turn, support the deck. At the location of each floorbeam, a 6'8" curvilinear bracket supports the sidewalk. These spandrel columns have simple, beveled capitals and are adjoined by non-structural, 12" thick, pre-cast spandrel arches hung from the deck. The span and proportion of these spandrel arches complement the five greater arches below. The two inner pairs of spandrel columns are integral with a length of solid spandrel wall.

In each arched span the spandrel columns and the floorbeams they support form a series of transverse arches spanning the two arch rings and the space that separates them. The arch that is formed over the two spandrel columns of an arch ring is semi-circular with a radius of 4'4"; the arch formed over the 15-foot space between rings is dual-centered, both having a radius of 4'4".

Each arch ring springs from a central pier or "shaft" with an overall width (along the roadway) of 15 feet. The loads on the structure did not require solid concrete piers. A drainpipe extends from the deck through this hollow shaft to the ground below.

At the sidewalk level, cantilevered platforms project from the outer faces of the piers to form six sidewalk balconies 12'6" wide.

Arch C-D has a span of 160 feet, the longest span of the five arches. The arch rings are approximately 4 feet thick at the spring line, tapering to 2' at the crown. Viewed in elevation, the spandrel columns form eleven distinct segments: an arcade of four 12'4" spandrel arches at either end of the main arch ring and an area equal to three closed spandrel segments at the arch crown. This arch spans the Blackstone River.

Arches B-C and D-E, flanking the central arch, are identical. The span of these arches is 125 feet. The arch rings are approximately 3'6" thick at the spring line, tapering to 1'9" at the crown. Viewed in elevation, the spandrel columns form nine distinct segments: an arcade of three 11'9" spandrel arches at both ends of the main arch ring and an area equal to three closed spandrel segments at the arch crown. Arch B-C spans River Road on the land separating the Blackstone Canal and the Blackstone River. Arch D-E originally spanned a mill trench (now filled) of the Ashton Mill; it now spans an enclosed, elevated walkway connecting a modern industrial building north of the viaduct and the Ashton Mill to its south.

The two end arches, A-B and E-F, are proportioned similarly to the 125-foot arches B-C and D-E, but are asymmetrical and of shorter span because they terminate in the bedrock of the slope of the Blackstone Valley. Thus, arch A-B, the westernmost, has a span of 114 feet. Arch E-F, the easternmost, has a span of 120 feet. The spandrel arches of these two spans are 11'9". Arch A-B spans the Blackstone Canal. Arch E-F spans the tracks of the Providence & Worcester Railroad.

The three approach spans between the west abutment and the two shafts of pier A form a concrete trestle consisting of eight columns resting on bedrock. Combined, these span a distance of approximately forty feet. These columns are 24" square and 30" square at the base, forming an arch configuration at the deck identical to that found on the spandrel columns. Perpendicular to the roadway, the four columns form arches at the floorbeams.

The five approach spans between the eastern abutment and the two shafts of pier F form a more complex concrete trestle consisting of 19 columns resting on bedrock. These columns are 24" square and 30" square at the base. The relative complexity of this trestle is due to the skewed southeast retaining wall following the alignment of the Mendon Road approach.

Piers B, C, D, and E, although similar in design, vary in footing dimension. Each of these piers consists of two 15-foot square plan shafts, sharing a large rectangular, approximately 11-foot high base. Piers B and E have footings 27'4" along the roadway and 55 feet wide. Piers C and D have footings 31 feet wide along the roadway and 60 feet wide. These footings rest on pilings. Piers A and F consist of two columns resting on bedrock; there are no shared footings.

The roadway consists of 14" thick deck slabs and a 2.5" thick

asphalt wearing surface. It is bound by a 12" high curb.

**Aesthetic treatments:** The spandrel arches, as mentioned above, are non-structural. A series of blind arches and pilasters adorn the below-deck face of the east and west abutments. These blind arches echo the transverse arch configuration at the floorbeams.

The reinforced concrete balustrade was substantially removed in a 1992 emergency repair. A typical section consisted of a length (varying from approximately 12 to 13 feet) of balusters with a coping 14" wide and 5" thick, and a base 14" wide and 12" high. The individual chamfered balusters were 5" square, 10.5" on center, and 22" high with beveled capitals and base. Measured from sidewalk height, the combined height of base, baluster, and coping was 39". These lengths of baluster were alternated with an 18" section of solid parapet located at the center line of the floorbeam and sidewalk bracket. The railing at the pedestrian alcoves was a solid parapet, its 15-foot length echoing the length of the pier below.

**Major alterations:** During the 1992 repair mentioned above, the sidewalks, balustrade railing, and sidewalk brackets were removed from the elevated sections of the viaduct. At that time a temporary walkway, a passage defined by two jersey barriers and a chain-link fence, was created on the south flank. On the north flank there is a single jersey barrier. Four small lengths of original balustrade and solid parapet remain at both approaches. These remaining sections, each roughly 30 feet in length, bear the four blue and white ceramic identification plaques of the Rhode Island Department of Public Works.

NOTES

1. Bayles, in the second volume of his *History of Providence County*, describes "a large sum expended for the bridge at Ashton" in 1873. This may have been allotted for significant repair or the erection of a new timber bridge (1891: New York, W.W. Preston and Company, p. 424).
2. RI Department of Public Works documents from the period describe this bridge as the "Lincoln-Cumberland Bridge."
3. Over these 46 miles there is a drop of some 400 feet.
4. Doug Reynolds. "Ship's Captain, Shop's Cotton." *Rhode Island History* 49 (May 1991): 49
5. *ibid*, p. 41
6. Kelly sat on the Board of Directors of the Blackstone Canal Company.
7. The 1982 *Statewide Historic Preservation Report* for Lincoln describes the mill houses: "They are all 1 1/2-story, 5-bay structures with center chimneys, except for 1027 [Lower River Road] which has two chimneys and was built as a 2-family house. The houses at 1016 and 1027 have gambrel roofs; 1014 and 1018 have gable roofs." (p. 64) On the Kelley House: "A 3-bay, 1 1/2-story, Greek Revival house with center door, the...house has been covered with new siding. The house sits on the towpath of the canal, adjacent to the site of the Smithfield Woolen and Cotton Company's mill built ca. 1812..." (p. 56)
8. *Report on the Roads and Public Highways of Rhode Island*. Providence: E.L. Freeman, 1895.
9. *Eleventh Annual Report of the R.I. State Board of Public Roads* (January 1913): 29
10. This bridge, a 75' reinforced concrete arch (No. 71), was removed in 1954 because of its narrow 16' wide roadway.
11. "Road Honors Washington: Cumberland-Coventry Highway to be Named for Father of Country in 200th Anniversary Year." *The Providence Sunday Journal Magazine* (5 July 1931): 4

12. *13th Annual Report of the Rhode Island State Board of Public Roads* (January 1932): 93

13. *8th Annual Report of the Rhode Island Department of Public Works*. (January 1943): 148

14. This viaduct spanned the Woonasquatucket River and a single track of the Pascoag Branch of the New York New Haven & Hartford Railroad. With an overall length of 449', it comprises eight T-beam approach spans and a single, 80', three-rib, open-spandrel arch. Daniel Cargill, Chief Bridge Engineer of the State Board of Public Roads, designed the viaduct and supervised its construction. In a May 1934 *Engineering News-Record* article, Cargill described four significant considerations in the design and construction:

[the \$3.25/sq. ft. cost] is believed unusually low for such a structure considering its height and loading. Second, both the design and the location of the structure were influenced more by the criteria of highway grade and alignment than the economics of the structure itself. Third, particular care was taken to ensure a structure of fine appearance. Fourth, certain details of design were noted to preserve the appearance against disfiguration by storm and weathering.

15. A partial copy of Engdahl's 1943 draft deferment application is found in the Department of Public Works Bridge Section correspondence at the Rhode Island State Archives. Engdahl's date of hire was Dec. 26, 1928. His job title and description for 1943 are as follows:

Senior Bridge Designer. His duties include all phases of the computation for and design of highway bridges in timber, steel, and concrete and/or analysis of temporary structures incidental to construction and operation, and the analysis of existing bridges for determination of suitable reinforcement or reconstruction methods where required.

16. The "Reorganization Act" (Chapter 2188, RI Public Laws) passed by the RI General Assembly on January 1, 1935 created eleven departments out of approximately 80 boards, bureaus, commissions, and agencies. The State Board of Public Roads was thus incorporated into a new Department of Public Works.

17. "Beltline road may be finished." *Providence Journal* (30 June 1940): 16

18. *6th Annual Report of the RI Department of Public Works*, January 1942

19. In the late 1920s the Hoover Committee on National Safety recommended a 22' roadway (11' for each travel lane), with 9' for additional travel lanes. This would add up to a total width of 40'. (Source: *Highway Engineer's Handbook*. New York: Mc Graw-Hill, 1927. pp 203-4)

20. Leo C. Donahue. "Blackstone Valley Viaduct At Ashton Nearing Completion." Undated *Providence Journal* article, ca. 1944

21. The longest, pre-dating the completion of the Ashton Viaduct by 13 years, is the south span of the Washington Bridge (1932). Designed and built by a special State Commission, the bridge has an overall length of 1,864 feet. Each arch span of this open spandrel structure consists of six arch ribs. This open spandrel design, however, is concealed by stone coverings in keeping with its neo-classical design. The movable center span of this bridge--no longer in use--is a double-leaf bascule type.

22. This video is on file at the office of the Principal Historic Preservation Specialist at RI Department of Transportation. Dave Johnson, now in his mid-80s was interviewed by phone for this report. He retains a strong interest in the Ashton Viaduct and requested that the author pass on his strong concern for proper bridge maintenance.

23. Harrison Howe, *The New Stone Age* (New York: The Century Co., 1921), pp. 85-86

24. This structure of some 135 miles was intended to be built of masonry and cast iron. The chief engineer of the project, a M. Belgrand, chose to use the *beton-agglomeré* of Coignet for a 37-mile section of the aqueduct notable for its difficult topography. For a thorough discussion of the project see "The Aqueduct of La Vanne." *The Manufacturer and Builder* 2 (May 1870): 143-5,. While the use of reinforcement is not discussed in this article, it is briefly mentioned in Harrison Howe, *The New Stone Age*, New York: The Century Co., 1921, p. 86

25. Frank McKibben. *Concrete-Cement Age* 1 (December 1912): 50

26. *ibid*

27. Henry Gratten Tyrell, in his *History of Bridge Engineering* (Chicago: by the author, 1911) describes, among others, the Danville and Terre Haute railroad bridges of the Big Four Railroad; the Piney Creek Bridge in Washington, D.C.; and the Walnut Lane Bridge in Philadelphia.

28. There is a significant departure in design between the Tunkhannock and Ashton Viaducts. While Ashton employs a series of arch columns carrying the deck load to the arch rings, Tunkhannock--as is characteristic of earlier open spandrel design--uses solid transverse arch walls running the full width of the deck. For a contemporary physical description of the construction of the Tunkhannock Creek Viaduct see George Hool, *Reinforced Concrete Construction* (New York: McGraw-Hill, 1916): 548-74.

SOURCES OF INFORMATION/BIBLIOGRAPHY

**Engineering Drawings:**

28 original construction drawings as well as subsequent repair, modification, and demolition drawings are on file at the Rhode Island Department of Transportation, Plan Room, 2 Capital Hill, Providence, Rhode Island.

**Historic Views:**

600 black and white photographs (approximately 3.25" x 5.5" format) documenting construction and repair of the Ashton Viaduct from 1930 to 1961 are on file at the R.I. Department of Transportation. The corresponding negatives are on file at the Rhode Island State Archives, 337 Westminster Street, Providence, R.I.

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"The La Vanne Aqueduct." *The Manufacturer and Builder* 2 (May 1870): 143-5

Unpublished material:

*Draft Section 106 Preliminary Case Report, Joseph A. Russo Memorial Bridge 275.* Prepared by Maguire Group, June 1995. On file at RI Department of Transportation

*Field Notes. Ashton Viaduct No. 275.* Two volumes of field notes

from the construction of the substructure and three volumes from the construction of the superstructure. On file at Rhode Island State Archives (Box 2, RIDOT collection)

Engineer's Calculation Sheets of Samuel A. Engdahl, dated November 1932 to June 1933. On file at Bridge Department, RI Department of Transportation

Two folders of contract-related documents for both phases of construction. On file at Rhode Island State Archives (RIDOT collection)

Bridge Department correspondence (1943). On file at Rhode Island State Archives (Box 11, RIDOT collection)

Government Documents:

*Annual Report of the Rhode Island State Board of Public Roads*  
(1913 to 1935)

*Annual Report of the Rhode Island Department of Public Works*  
(1936-1946)

Clouette, Bruce and Roth, Matthew. *Rhode Island Historic Bridge Inventory*. Providence: RI Department of Transportation, 1988

*Statewide Historic Preservation Report P-L-1, Lincoln, Rhode Island*. R.I. Historical Preservation Commission: 1982

*Preliminary Survey Report, Town of Cumberland, Rhode Island*. R.I. Historical Preservation Commission: 1977

Supplemental Material:

*The following is the text of an appeal to the War Production Board from William J. Long, Deputy Director of the RI Department of Public Works dated April 5, 1943. This correspondence is in response to a "Revocation Order" (March 30, 1943) suspending work on the Ashton Viaduct for reasons of public interest and national defense.*

War Production Board P-19  
Washington  
D.C.

Re: Application for exceptions for revocation of order dated  
March 30, 1943, re: Ashton Viaduct. RI FAP 67-C (1) and  
Mendon Road RI FAP 41-E (1).

Gentlemen:--

Reference is made to revocation and suspension order dated March 30, 1943, relative to above subject.

The project is divided into two portions, namely, a reinforced cement concrete bridge and viaduct structure designated as FAP 67-C (1) and the approach construction designated as FAP 41-E (1).

The project was designed to complete a link in a circumferential route around that portion of the State where the cities of Central Falls, Pawtucket, Providence and Cranston are located and which forms the most serious obstacle to traffic through the state from north to south by reason of the serious congestion offered by its heavy population and manufacturing activities. The area outlined upon the accompanying map, #1, contains over 60% of the State's entire population, 70% of the State's manufacturing plants and over 55% of the State's dwelling houses. This is the area which the route by-passes upon which the project in question is the vital and closing link necessary to make the route usable in its entirety. There are, furthermore, no dependable bridging structures over the Blackstone River, with the exception of this project, when completed, between the City of Woonsocket and the Providence Metropolitan Area. This makes it necessary for the heavy commercial traffic originating between these two points to come into these already congested areas in order to disperse to the southern routes.

The structure when completed will make the by-pass route completely available for much military traffic which now passes through the congested areas with inconvenience and loss of time to itself and civilian traffic. Convoys coming south on Route 114 and Angell Road into Route 122 at Ashton must then swerve north or south over three (3) miles on Route 122 to effect a crossing of the Blackstone River on anything over an H3 capacity. This diversion adds additional mileage and time to the trip as it necessitates circuitous traveling to get back on main route by-passing the metropolitan areas.

As stated before the structure is of reinforced cement concrete. Suspension of work in its present stage would be extremely serious since the very many heavy steel reinforcing rods projecting from that portion of the structure now concreted and which subsequent pours would enclose, cannot be fully protected from corrosion and certainly cannot be replaced. The falsework and centering have been designed and fabricated for multiple re-use and any delay will cause rot and warping to render this make-up unfit for its purpose in a comparatively short while.

All of the timber is moreover subject to fire hazard and if it has to be relied on to furnish support for the heavy uncompleted concrete members it will soon constitute a serious menace to public safety.

As will be seen from the diagrammatic sketch, #3, the structure spans the main stream of the Blackstone River as well as the railroad tracks of the Providence-Worcester Division of the N.Y, N.H and H. R.R. and mill canals. Any obstruction due to failure of the centering, falsework or structure will be a serious hazard to the railroad or the streams. The river is subject to frequent flash floods and spring freshets which could wash out any temporary work at any time and becomes an increased hazard the longer it is left in place by reason of suspension or completion of the structure.

The debris from any such occurrence would damage and possibly destroy a light highway bridge just downstream as well as endanger several spillway structures on downstream power dams. Owners of these structures have already expressed concern over this possibility and as several textile plants engaged in war manufacturing are served by the water impounded by the dam structures.

It appears to us that the work necessitating the maintenance of the aforementioned formwork and centering, whose failure would

menace the railroad and the stream structures, should be allowed to proceed to completion so that the formwork and centering could be dispensed with.

Insofar as material for the project is concerned, all required critical material, fabricated and ready for use, is on hand at the site. Aggregates for concrete have been prepared and stock-piled and lumber is incorporated in forms and falsework. There are no outstanding preference ratings and no great need of such is anticipated.

The structure consists of five spans. In three spans the arch members are completed. The falsework is complete and the reinforcement is in place and concrete is being placed in two ribs of the remaining two spans. The ribs are constructed in sections and until all the sections or segments, together with their key blocks, are in place and in use, the arches are not self-supporting or safe to leave. To summarize briefly it can be said that the structure in its present state will become a definite hazard to public safety and to the war effort if left with no more adequate work done upon it than is possible to accomplish in the fifteen (15) days allotted.

It is not necessary to carry the approach project, FAP 41-F (1), to completion or much further than it exists at the present but it appears to us vitally necessary to bring the bridge and viaduct, Project 67-C (1), to a usable stage before suspending work.

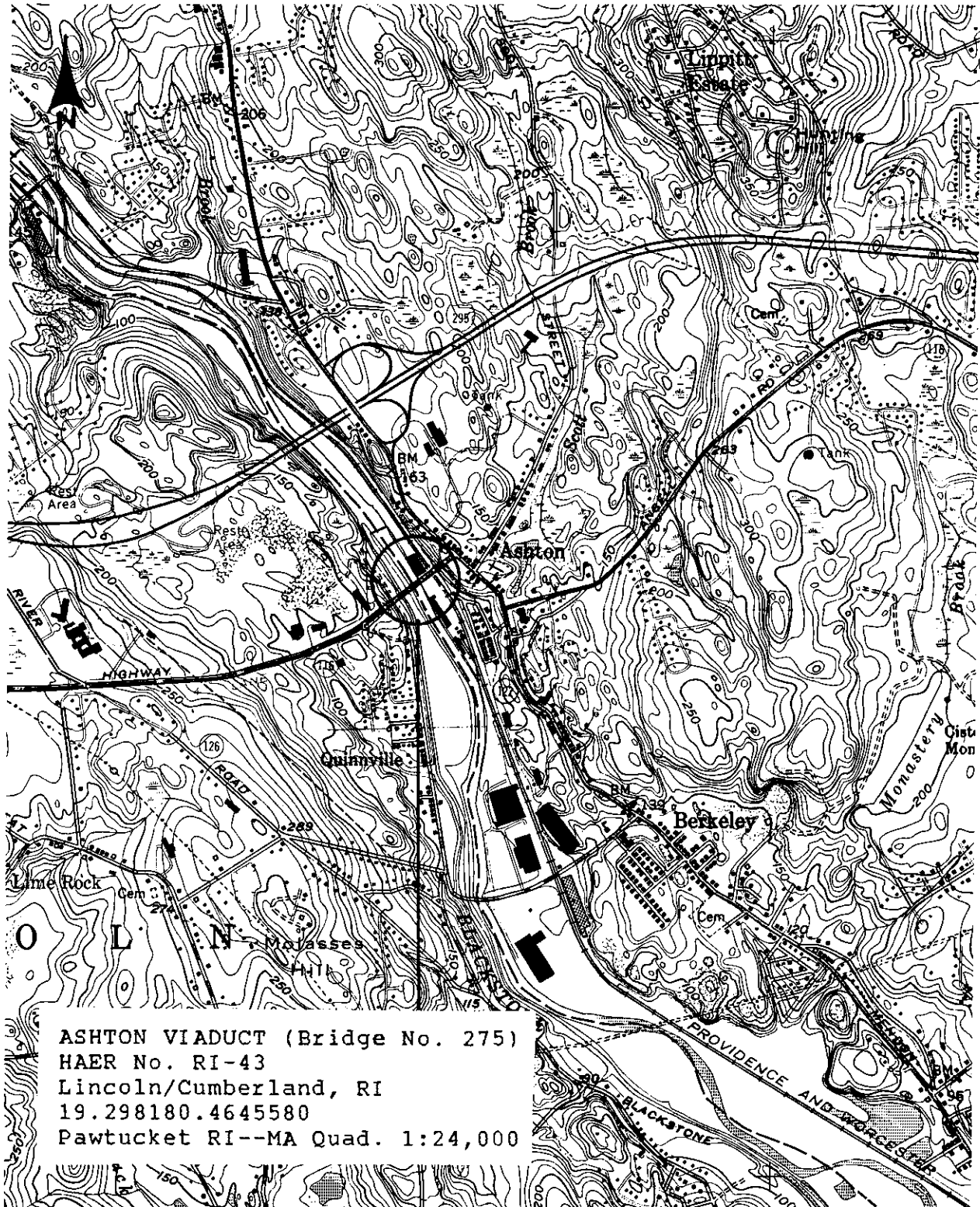
There are only two small pieces of construction equipment used on the work, 1 3/4 yard crane and a light truck. Concrete is being delivered from a commercial plant with entirely adequate facilities and which has only this project to serve at present.

The working force is small, consisting of about 30 men including all supervisory and clerical staffs.

In view of the above facts we herewith respectfully request reconsideration of the Order issued March 30, 1943 for revocation and suspension of Rhode Island Federal Aid Project No. 67-c (1).

Very truly yours,  
William J. Long,  
Deputy Director of Public Works.

ASHTON VIADUCT  
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ASHTON VIADUCT (Bridge No. 275)  
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**ASHTON VIADUCT**  
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